

THE PLANT-FORMATIONS OF EASTERN
MASSACHUSETTS.

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THIS paper is the result of studies on the eastern coast of Massachusetts and includes in general the region from Cape Ann to Plymouth and from Cape Cod to some 15 miles west of Boston. In the north this region is mainly broken and hilly, but southward spreads out into extensive sandy plains. It is bounded on the east by the sea with its extensive salt marshes and there are innumerable ponds and slow-flowing streams which support a characteristic vegetation, while the Blue Hills some 600 feet high are the most prominent landmark. Almost the whole region is sparsely wooded (about half with conifers), and much of it is covered with glacial drift. The numerous hills have usually their tops and upper slopes well denuded of soil and sparse of vegetation, and these hilltop barrens often support characteristic species. The bogs of the North here approach their southern limits and bring with them their own northern species. Withal, this debatable ground between the Carolinian and Canadian regions—often misnamed the Transitional Zone, possessing a flora made up of the mingling of the species of two very different regions and rich with intergrading forms, is one well worthy of study from the ecological as well as the systematic standpoint and these brief notes are offered more as an aid to others interested in its ecology than as a study complete in itself.

The range or area over which a given species may be naturally distributed is determined by latitude, altitude, humidity and geographical barriers, which serve to group species into "floras," each occupying an essentially distinct biological area. In each of these biological regions the flora comprises a number of segregated groups of plants occupying different areas called "habitats," each composed of essentially different species adapted to this particular combination of physical, chemical and biological conditions. The efficient factors of these plant-habitats are the chemical nature of the soil with its physical condition, the amount of contained water, the relative amount of sunlight and the effect of biological agents, somewhat modified by variation in temperature, exposure and proportion of humus present in the soil. The total aggregation of species usually

found occupying a given habitat is called a "plant-formation" from its analogy to geological formations.

There is often a considerable difference in the prevailing plant-formations of adjacent districts within the same biological region, due to difference in physiography and in the underlying rock formations, upon which the nature of the soil depends. In the district here considered the limestone areas with their characteristic plant-formations appear to be wholly absent, while more inland the saline formations are wanting. Another important element in the study of the ecology of a region is the variation in altitude above sea-level. The variation here scarcely exceeds 600 feet and may be left out of consideration, but in more mountainous districts this altitudinal variation is often sufficient to affect materially the distribution of species, which tend to group themselves at the different altitudes into zones corresponding in large part to the larger latitudinal zones of the continent, each having its own system of species and plant-formations.

In every district there is usually some dominant plant-formation, throughout which the other formations occur as lines and patches, without materially affecting the general physiognomy of the region, determined by the flora of this dominant formation, which is here the upland forest composed of the Sand Plain and Hilly Upland Formations, dependent upon the nature of the soil.

The classification followed differs in several important particulars from those usually given and is based (1) upon the soil, (2) the amount of contained moisture and (3) upon the relative amount of sunlight, which by their several combinations form the plant-habitats of this region, to which must be added the three biological formations dependent upon other factors. The table below represents the possible combinations of these factors with the resulting plant-formations as they appear in our flora.

TABLE OF HABITAL FACTORS.

(The numbers refer to the synopsis of Plant formations following.)

Soil			silicious	argillaceous	calcare- ous	saline (<i>Halo- phytes</i>)
Humidity slight	<i>Xerophytes</i>	{	In sunlight	(1)	(2)	..... (m)
	or Arid Plants		In shade	.....	.....	.....
Humidity medium	<i>Mesophytes</i>	{	In sunlight	(n)	(o)	.....
	or Upland Plants		In shade	(3)	(4)	.....
Humidity great	<i>Hygrophytes</i>	{	In sunlight	(5)	(6)	..... (7)
	or Lowland Plants		In shade	(8)	(8)	.....
Saturated or nearly so	<i>Helophytes</i>	{	In sunlight	(9a & 9b)	(9a & 9b)	..... (10)
	or Swamp Plants		In shade	(11)	(11)	.....
Submersed	<i>Hydrophytes</i>	{	rooted	(12)	(13)	..... (14)
	or Aquatic Plants		floating	(15)	(15)	..... (16)
Special Adaptations :		Dependent upon human habitation				(17)
		" " " cultivation.				(18)
		Saprophytic or parasitic on other organisms.				(19)

It is probable that there are other plant-formations besides those here given. There may be found a limestone formation with its characteristic species to parallel the silicious, argillaceous and saline series given. A sea-cliff formation (m) may occur northward along the coast, as a number of peculiar species are found at Nahant and Cape Ann in such situations. There may be a district flora characteristic of "dry open places" (n), (o), or of the upland thickets intermediate between (1-2) and (3-4), but, if so, it certainly is not very pronounced. In this classification, I have endeavored to give only those plant-formations which stand out with clearness and are easily segregated by their flora, recognizing the fact that they all intergrade with each other and that many species are common to a series having the same soil or the same relative amount of humidity, while others, like weeds, pay little regard to any of these conditions.

The species here italicized as "characteristic" of each formation are those usually found here only in the given formation and occurring rarely elsewhere; the other species listed are common in the formation but not at all confined to it. By far the greater part of the flora

appears to fall into this latter class of *generalized species*, though the list of characteristic species may be largely extended.

It is only by thus dividing the flora of a district into its component plant-formations and recognized habitats that any system can be introduced into the present unscientific method of quoting specific habitats and any studies attempted on specific variation based upon the influence of environment.

The local plant-formations may best take their names from the habitats of which they are characteristic and hence in the district here considered we have the following :

SYNOPSIS OF THE PLANT-FORMATIONS OF EASTERN MASSACHUSETTS.

I. Soil humidity slight. *Xerophytes* or Arid Plants.
(Little or no forest vegetation and hence no shade.)

- A. Soil silicious 1. SAND-BARREN FORMATION.
- B. Soil argillaceous 2. HILLTOP-BARREN FORMATION.

II. Soil humidity medium. *Mesophytes* or Upland Plants.
(These uplands forested and consequently mainly shade vegetation.)

- A. Soil silicious 3. SAND-PLAIN FOREST FORMATION.
- B. Soil argillaceous 4. HILLY UPLAND-FOREST FORMATION.

III. Soil humidity great. *Hygrophytes* or Lowland Plants.
a. In full sunlight.

- A. Soil silicious 5. SAND-POND MARGIN FORMATION.
- B. Soil argillaceous 6. LOW-MEADOW FORMATION.
- C. Soil saline (*Halophytes*) 7. SEA-SHORE FORMATION.

b. In the shade.

- A & B. Soil silicious or argillaceous with abundant humus. 8. LOW-WOODLAND FORMATION.

IV. Soil saturated. *Helophytes* or Swamp Plants.
a. In full sunlight.

- A & B. Soil silicious or argillaceous.
 - with little or no Sphagnum 9a. SWAMP FORMATION.
 - with much Sphagnum 9b. BOG FORMATION.
- C. Soil saline (*Halophytes*) 10. SALT-MARSH FORMATION.

b. In deep shade.

- A & B. Soil silicious or argillaceous 11. BOGGY-WOODLAND FORMATION.

V. Soil submersed. *Hydrophytes* or Aquatic Plants.
(All necessarily in full sunlight.)

a. Plants fixed.

- A. Substratum sandy 12. SAND-POND FORMATION.
- B. Substratum argillaceous 13. MUD-POND FORMATION.
- C. Substratum saline 14. SEA-SHOAL FORMATION.

b. Plants floating freely; substratum unimportant.

- A & B. In fresh water 15. FRESH-WATER FORMATION.
- C. In salt water 16. PELAGIC FORMATION.

VI. Special Adaptations. *Biophytes*.

- a.* Dependent upon human habitation 17. WASTE-LAND FORMATION.
- b.* Cultivated by man for his use or admiration 18. ECONOMIC FORMATION.
- c.* Saprophytic or parasitic on other organisms 19. FUNGOID FORMATION.

In the following lists given for the different formations the nomenclature of Gray's Manual, 6th edition, is mainly followed and also in general the same specific limits. Trees are starred (*) and shrubs marked thus (°), while the species characteristic of the different formations are *italicized*.

1. SAND-BARREN FORMATION. *Xerophytes.*

Habitat: dry sand hills, drifting sands, and open sandy fields and plains, where the common species fail to maintain a foothold; flora well-marked but rather local, except in the Cape Cod region; species few and characteristic. Passes into (3) and (7).

<i>Hudsonia tomentosa</i> , Nutt.	<i>Krigia Virginica</i> , Willd.
<i>H. ericoides</i> , L.	<i>Aralia hispida</i> , Vent.
° <i>Arctostaphylos Uva-ursi</i> , Spreng.	<i>Aster linariifolius</i> , L.
<i>Lechea minor maritima</i> , Gray.	<i>Lechea thymifolia</i> , Michx.
° <i>Ilex glabra</i> , Gray.	° <i>Myrica cerifera</i> , L.
<i>Hypericum nudicaule</i> , Walt.	<i>Spiranthes simplex</i> , Gray.
<i>Cyperus filiculmis</i> , Vahl.	° <i>Smilax rotundifolia</i> , L.
<i>Chrysopsis falcata</i> , Ell.	<i>Corema Conradii</i> , Torr.
<i>Cyperus Grayii</i> , Torr.	<i>Lechea tenuifolia</i> , Michx.

2. HILLTOP-BARREN FORMATION. *Xerophytes.*

Habitat: high points of slate or granite exposed by denudation, or cliffs; very local; passing into (4).

° <i>Quercus prinoides</i> , Willd.	<i>Cardamine parviflora</i> , L.
° <i>Q. ilicifolia</i> , Wang.	<i>Polygonum tenue</i> , Michx.
* <i>Juniperus Virginiana</i> , L.	<i>Aster linariifolius</i> , L.
° <i>J. communis alpina</i> , Gaud.	<i>Aristida dichotoma</i> , Michx.
° * <i>Prunus Pennsylvanica</i> , L. f.	<i>Corydalis glauca</i> , Pursh.
° <i>P. cuneata</i> , Raf.	<i>Krigia Virginica</i> , Willd.
° <i>Arctostaphylos Uva-ursi</i> , Spreng.	<i>Houstonia purpurea longifolia</i> , Gray.
° <i>Rhus typhina</i> , L.	° <i>Vaccinium Pennsylvanicum</i> , Lam.
* <i>Pinus rigida</i> , Mill.	<i>Ranunculus fascicularis</i> , Muhl.
<i>Silene Pennsylvanica</i> , Michx.	<i>Lespedeza capitata</i> , Michx.
<i>Viola pedata</i> , L.	<i>Andropogon scoparius</i> , Michx.
<i>V. ovata</i> , Nutt.	<i>Selaginella rupestris</i> , Spring.
<i>Aralia hispida</i> , Vent.	* ° <i>Prunus Virginiana</i> , L.
<i>Lechea tenuifolia</i> , Michx.	

More frequent on the cliffs :

<i>Saxifraga Virginiensis</i> , Michx.	<i>Woodsia ilvensis</i> , R. Br.
<i>Aquilegia Canadensis</i> , L.	<i>Asplenium Trichomanes</i> , L.
° <i>Rhus Toxicodendron</i> , L.	<i>Polypodium vulgare</i> , L.

3. SAND-PLAIN FOREST FORMATION. *Mesophytes.*

Habitat: Sand or sandstone substratum, nearly level and covered with an open forest growth, which affords suitable conditions of shade and humidity and moderate accumulation of humus; passing into (1) in more exposed situations, into (5) or (8) in low ground and into (7) along the coast. Species relatively few and vegetation often scattered.

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| * <i>Quercus alba</i> , L. | <i>Cyperus filiculmis</i> , Vahl. |
| * <i>Pinus rigida</i> , Mill. | <i>Danthonia spicata</i> , Beauv. |
| * <i>Carya alba</i> , Nutt. | <i>Spiranthes gracilis</i> , Bigel. |
| * <i>Quercus coccinea tinctoria</i> , Gray. | <i>Hieracium venosum</i> , L. |
| ° <i>Gaylussacia resinosa</i> , T. & G. | <i>Lupinus perennis</i> , L. |
| ° <i>Vaccinium vacillans</i> , Soland. | <i>Helianthemum Canadense</i> , Michx. |
| ° <i>Rhus copallina</i> , L. | <i>Baptisia tinctoria</i> , R. Br. |
| ° <i>Myrica asplenifolia</i> , Endl. | <i>Viola pedata</i> , L. |
| <i>Apocynum androsæmifolium</i> , L. | <i>Polygala polygama</i> , Walt. |
| <i>Cypripedium acaule</i> , Ait. | <i>Lespedeza capitata</i> , Michx. |
| <i>Epigæa repens</i> , L. | <i>Deschampsia flexuosa</i> , Trin. |
| <i>Linaria Canadensis</i> , Dumort. | <i>Oenothera pumila</i> , L. |
| <i>Asclepias obtusifolia</i> , Michx. | <i>Festuca tenella</i> , Willd. |
| <i>Gaultheria procumbens</i> , L. | <i>Sericocarpus conyzoides</i> , Nees. |
| <i>Crotalaria sagittalis</i> , L. | * <i>Betula populifolia</i> , Ait. |
| <i>Solidago odora</i> , Ait. | <i>Tephrosia Virginiana</i> , Pers. |
| ° <i>Ceanothus Americanus</i> , L. | <i>Prenanthes serpentaria</i> , Pursh. |

4. HILLY UPLAND-FOREST FORMATION. *Mesophytes.*

Habitat: Argillaceous soil with slate or granite base, often glacial drift; rough hilly woodlands including most of the region, with a rich and diversified flora, but apparently with few species characteristic; passing in exposed situations into (2) and in low ground into (6), (8), (9) or (11), but is often contiguous to and may pass into nearly all the other formations; often denominated "dry hillsides," "rocky slopes," "rocky open woods," etc. This is the dominant formation of the region.

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| * <i>Quercus alba</i> , L. | <i>Viola ovata</i> , Nutt. |
| <i>Q. coccinea tinctoria</i> , Gray. | <i>Hedeoma pulegioides</i> , Pers. |
| * <i>Q. rubra</i> , L. | <i>Gerardia tenuifolia</i> , Vahl. |
| * <i>Carya alba</i> , L. | <i>G. quercifolia</i> , Pursh. |
| * <i>C. porcina</i> , Nutt. | <i>G. flava</i> , L. |
| * <i>Prunus serotina</i> , Ehrh. | <i>Lobelia inflata</i> , L. |
| * <i>Sassafras officinale</i> Nees. | <i>Solidago nemoralis</i> , Ait. |
| * <i>Populus tremuloides</i> , Michx. | <i>S. bicolor</i> , L. |

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| * <i>Ostrya Virginica</i> , Willd. | <i>Solidago Canadensis</i> , L. |
| * <i>Castanea sativa Americana</i> , Gray. | <i>S. rugosa</i> , Mill. |
| * <i>Fagus ferruginea</i> , Ait. | <i>Aster undulatus</i> , L. |
| * <i>Tsuga Canadensis</i> , Carr. | <i>Geum album</i> , Gmelin. |
| ° <i>Rhus typhina</i> , L. | <i>Lespedeza polystachya</i> , Michx. |
| ° <i>R. glabra</i> , L. | <i>Geranium maculatum</i> , L. |
| ° <i>Rubus Canadensis</i> , L. | <i>Anemone nemorosa</i> , L. |
| ° <i>R. occidentalis</i> , L. | <i>A. Virginica</i> , L. |
| ° <i>Corylus Americana</i> , Walt. | <i>Hieracium scabrum</i> , Michx. |
| ° <i>C. rostrata</i> , Ait. | <i>Carex Pennsylvanica</i> , Lam. |
| ° <i>Vaccinium vacillans</i> Soland. | <i>Desmodium paniculatum</i> , DC. |
| ° <i>Myrica asplenifolia</i> , Endl. | <i>Polygala paucifolia</i> , Willd. |
| <i>Lysimachia quadrifolia</i> , L. | <i>Baptisia tinctoria</i> , R. Br. |
| <i>Melampyrum Americanum</i> , Michx. | <i>Bidens frondosa</i> , L. |

5. SAND-POND MARGIN FORMATION. *Hygrophytes*.

Habitat: wet open sandy places, about ponds and along streams; passing into (3) above and into (12) below. Very local and species few but characteristic; mainly in the Plymouth and Cape Cod regions.

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| <i>Coreopsis rosea</i> , Nutt. | <i>Hemicarpha subsquarrosa</i> , Nees. |
| <i>Drosera filiformis</i> , Raf. | <i>Eleocharis tuberculosa</i> , R. Br. |
| <i>D. intermedia Americana</i> , DC. | <i>Panicum virgatum</i> , L. |
| <i>Viola lanceolata</i> , L. | <i>P. verrucosum</i> , Muhl. |
| <i>Rhexia Virginica</i> , L. | <i>Solidago tenuifolia</i> , Pursh. |
| <i>Utricularia resupinata</i> , B. D. Greene. | <i>Stachys hyssoipifolia</i> , Michx. |
| <i>U. cornuta</i> , Michx. | <i>Cyperus aristatus</i> , Rottb. |
| <i>Hypericum Canadense</i> , L. | <i>Bartonia tenella</i> , Muhl. |
| <i>Polygala sanguinea</i> , L. | <i>Ranunculus Cymbalaria</i> , Pursh. |
| <i>Lobelia Dortmanna</i> , L. | <i>Myriophyllum tenellum</i> , Bigel. |
| <i>Juncus pelocarpus</i> , E. Meyer. | <i>Cyperus flavescens</i> , L. |
| <i>J. dichotomus</i> , Ell. | <i>Eriocaulon septangulare</i> , With. |
| <i>Cyperus dentatus</i> , Torr. | <i>Eleocharis olivacea</i> , Torr. |
| <i>Psilocarya scirpoides</i> , Torr. | <i>Juncus Greenei</i> , Oakes & Tuckerm. |
| <i>Eleocharis melanocarpa</i> , Torr. | <i>Fimbristylis autumnalis</i> , R. & S. |

6. LOW-MEADOW FORMATION. *Hygrophytes*.

Habitat: wet open places with argillaceous soil; often denominated "low open places," "swamp and stream margins," "about springs," "wet meadows," "muddy pond margins," "brooksides," "river-banks," "wet thickets," &c; passes normally into (4) above and into (9), (11) or (13) below. Flora abundant and characteristic.

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| ° <i>Cornus sericea</i> , L'Her. | <i>L. sinuatus</i> , L. |
| ° <i>Pyrus arbutifolia</i> , L. f. | <i>Epilobium coloratum</i> , Muhl. |
| ° <i>Rubus hispidus</i> , L. | <i>Polygonum acre</i> , HBK. |
| ° <i>Spiræa salicifolia</i> , L. | <i>P. Hydropiper</i> , L. |
| ° <i>S. tomentosa</i> , L. | <i>Arenaria lateriflora</i> , L. |
| ° <i>Vaccinium corymbosum</i> , L. | <i>Gerardia purpurea paupercula</i> , Gray. |
| ° <i>Salix discolor</i> , Muhl. | <i>Houstonia cærulea</i> , L. |
| ° <i>S. rostrata</i> , Rich. & other spp. | <i>Eupatorium purpureum</i> , L. |
| ° <i>Viburnum dentatum</i> , L. | <i>Hypericum mutilum</i> , L. |
| ° <i>Ilex verticillata</i> , Gray. | <i>Viola blanda</i> , Willd. |
| <i>Spiranthes cernua</i> , Rich. | <i>V. lanceolata</i> , L. |
| <i>Lysimachia stricta</i> , Ait. | <i>Iris versicolor</i> , L. |
| <i>Steironema ciliatum</i> , Raf. | <i>Elodes campanulata</i> , Pursh. |
| <i>Saxifraga Pennsylvanica</i> , L. | <i>Mimulus ringens</i> , L. |
| <i>Eupatorium perfoliatum</i> , L. | <i>Cyperus strigosus</i> , L. |
| <i>Glyceria Canadensis</i> , Trin. | <i>Lobelia spicata</i> , Lam. |
| <i>Hypericum ellipticum</i> , Hook. | <i>Juncus effusus</i> , L. |
| <i>Scirpus atrovirens</i> , Muhl. | <i>Aspidium Thelypteris</i> , Swartz. |
| <i>Carex crinita</i> , Lam. & other spp. | <i>A. Noveboracense</i> , Swartz. |
| <i>Eleocharis ovata</i> , R. Br. | <i>Aster paniculatus</i> , Lam. |
| <i>E. acicularis</i> , R. Br. | <i>Bidens connata</i> , Muhl. |
| <i>Ranunculus septentrionalis</i> , Poir. | <i>B. cernua</i> , L. |
| <i>Solidago lanceolata</i> , L. | <i>Asclepias incarnata pulchra</i> , Pers. |
| <i>Phragmites communis</i> , Trin. | <i>Cardamine Pennsylvanica</i> , Muhl. |
| <i>Lycopus Virginicus</i> , L. | |

7. SEA-SHORE FORMATION. *Halohygrophytes*.

Habitat: sandy sea-beaches and high-tide flats, or sandy sea-shore immediately adjacent; soil more or less saline, passes into (3) above and (14) below. Flora sparse; species few and characteristic.

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| <i>Cakile Americana</i> , Nutt. | <i>A. caudata</i> , Michx. |
| * <i>Prunus maritima</i> , Wang. | <i>Salsola Kali</i> , L. |
| <i>Euphorbia polygonifolia</i> , L. | <i>Xanthium Canadense echinatum</i> ,
Gray. |
| <i>Chenopodium rubrum</i> , L. | <i>Ammophila arundinacea</i> , Host. |
| <i>Atriplex arenarium</i> , Nutt. | <i>Lathyrus maritimus</i> , Bigel. |
| <i>Glaux maritima</i> , L. | <i>Polygonella articulata</i> , Meisn. |
| <i>Arenaria peploides</i> , L. | <i>Solidago sempervirens</i> , L. |
| <i>Triodia purpurea</i> , Hack. | <i>Buda maritima</i> , Dumort. |
| <i>Statice Limonium Caroliniana</i> , Gray. | <i>Salicornia ambigua</i> , Michx. |
| <i>Artemisia Stelleriana</i> , Bess. | |

8. LOW-WOODLAND FORMATION. *Hygrophytes*.

Habitat: low alluvial woodlands; soil moist with deep shade and much humus; substratum unimportant; passes from (3) or (4) above into any lowland or aquatic formation; often spoken of as "low

woods," "moist shady places," "deep forests," "rich woods" and like terms. These moist cool woods have a very characteristic vegetation.

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| * <i>Acer rubrum</i> , L. | <i>Sanguinaria Canadensis</i> , L. |
| * <i>A. saccharinum</i> , Wang. | <i>Trillium cernuum</i> , L. |
| * <i>Tilia Americana</i> , L. | <i>Oakesia sessilifolia</i> , Wats. |
| * <i>Platanus occidentalis</i> , L. | <i>Erythronium Americanum</i> , Ker. |
| * <i>Ulmus Americana</i> , L. | <i>Impatiens fulva</i> , Nutt. |
| * <i>Pinus Strobus</i> , L. | <i>Pilea pumila</i> , Gray. |
| * <i>Quercus coccinea</i> , Wang. | <i>Allium Canadense</i> , Kalm. |
| * <i>Fraxinus Americana</i> , L. | <i>Ranunculus abortivus</i> , L. |
| ◦ <i>Amelanchier Canadensis oblongifolia</i> , Torr. & Gray. | <i>Geranium maculatum</i> , L. |
| ◦ <i>Alnus incana</i> , Willd. | <i>G. Robertianum</i> , L. |
| ◦ <i>A. serrulata</i> , Willd. | <i>Osmunda cinnamomea</i> , L. |
| ◦ <i>Ampelopsis quinquefolia</i> , Michx. | <i>Asplenium Filix-foemina</i> , Bernh. |
| ◦ <i>Rhus Toxicodendron</i> , L. | <i>Medeola Virginica</i> , L. |
| <i>Arisaema triphyllum</i> , Torr. | <i>Cornus Canadensis</i> , L. |
| <i>Maianthemum Canadense</i> , Desf. | <i>Viola cucullata</i> , Ait. |
| <i>Circaea Lutetiana</i> , L. | <i>Actaea alba</i> , Bigel. |
| <i>C. alpina</i> , L. | <i>Solidago latifolia</i> , L. |
| <i>Boehmeria cylindrica</i> , Willd. | <i>S. ulmifolia</i> , Muhl. |
| <i>Aralia nudicaulis</i> , L. | <i>S. serotina</i> , Ait. |
| <i>Viola pubescens</i> , Ait. | <i>Veratrum viride</i> , Ait. |
| <i>V. blanda</i> , Willd. | <i>Prenanthes alba</i> , L. |

9a. SWAMP FORMATION. *Helophytes*.

Habitat: open swamps and marshes; soil more or less submersed; water shallow, often drying up in summer; plants amphibious or partly emersed; similar conditions in margins of ponds and shallow streams.

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| <i>Sagittaria variabilis</i> , Engelm. | <i>Lathyrus palustris</i> , L. |
| <i>S. heterophylla</i> , Pursh. | <i>Equisetum limosum</i> , L. |
| ◦ <i>Alnus incana</i> , Willd. | <i>Decodon verticillatus</i> , Ell. |
| ◦ <i>A. serrulata</i> , Willd. | <i>Veronica scutellata</i> , L. |
| ◦ <i>Rosa lucida</i> , Ehrh. | <i>Cardamine Pennsylvanica</i> , Muhl. |
| ◦ <i>Myrica Gale</i> , L. | <i>Caltha palustris</i> , L. |
| ◦ <i>Rhus venenata</i> , DC. | <i>Sparganium eurycarpum</i> , Engelm. |
| ◦ <i>Cephalanthus occidentalis</i> , L. | <i>Iris versicolor</i> , L. |
| <i>Ludwigia palustris</i> , L. | <i>Typha latifolia</i> , L. |
| <i>Proserpinaca palustris</i> , L. | <i>Carex stricta</i> , Lam. |
| <i>Cicuta maculata</i> , L. | <i>Sparganium simplex</i> , Huds. |
| <i>C. bulbifera</i> , L. | <i>Peltandra undulata</i> , Raf. |
| <i>Acorus Calamus</i> , L. | <i>Zizania aquatica</i> , L. |
| <i>Sium cicutaefolium</i> , Gmelin. | <i>Glyceria fluitans</i> , R. Br. |
| <i>Alisma Plantago</i> , L. | <i>Rumex Brittanica</i> , L. |
| <i>Pontederia cordata</i> , L. | <i>Bidens chrysanthemoides</i> , Michx. |

9b. BOG FORMATION. *Helophytes*.

Habitat: similar to the preceding but characterized by the abundance of *Sphagnum* species, which form a close mat over the surface and maintain more equable conditions of temperature and moisture and thus permit the southern extension of many northern species. Flora very distinct from the preceding, with many Ericaceous shrubs.

◦ <i>Vaccinium macrocarpon</i> , Ait.	<i>Eriophorum gracile</i> , Koch.
◦ <i>V. Oxycoccus</i> , L.	<i>E. vaginatum</i> , L.
◦ <i>Cassandra caliculata</i> , Don.	<i>Arethusa bulbosa</i> , L.
◦ <i>Andromeda polifolia</i> , L.	<i>Cladium mariscoides</i> , Torr.
◦ <i>Kalmia glauca</i> , Ait.	<i>Drosera rotundifolia</i> , L.
◦ <i>Ledum latifolium</i> , Ait.	<i>D. intermedia Americana</i> , DC.
◦ <i>Rhododendron Rhodora</i> , Don.	<i>Utricularia cornuta</i> , Michx.
<i>Sarracenia purpurea</i> , L.	<i>Clintonia borealis</i> , Raf.
<i>Chiogenes serpyllifolia</i> , Salisb.	<i>Calla palustris</i> , L.
<i>Smilacina trifolia</i> , Desf.	<i>Geum rivale</i> , L.
<i>Rhynchospora alba</i> , Vahl.	<i>Calopogon pulchellus</i> , R. Br.
<i>Epilobium lineare</i> , Muhl.	<i>Pogonia ophioglossoides</i> , Nutt.
<i>Menyanthes trifoliata</i> , L.	<i>Habenaria lacera</i> , R. Br.
<i>Sphagnum</i> spp.	

10. SALT-MARSH FORMATION. *Halohelophytes*.

Habitat: mud flats covered by the sea at extreme tides and supporting a short but dense vegetation; frequent along the coast. Brackish meadows have a mixture of this flora and that of (9a). No shrubs.

<i>Gerardia maritima</i> , Raf.	<i>Solidago sempervirens</i> , L.
<i>Salicornia herbacea</i> , L.	<i>Carex maritima</i> , O. F. Mueller.
<i>Suaeda linearis</i> , Moq.	<i>Statice Limonium Caroliniana</i> , Gray.
<i>Juncus Gerardi</i> , Loisel.	<i>Aster subulatus</i> , Michx.
<i>Spartina juncea</i> , Willd.	<i>Potentilla Anserina</i> , L.
<i>S. stricta glabra</i> , Gray.	<i>Scirpus maritimus</i> , L.
<i>Distichlis maritima</i> , Raf.	<i>Buda maritima</i> , L.
<i>Triglochin maritima</i> , L.	<i>Scirpus pungens</i> , Vahl.
<i>Puccinellia maritima</i> , Parl.	<i>Iris prismatica</i> , Pursh.
<i>Atriplex patulum hastatum</i> , Gray.	<i>Typha angustifolia</i> , L.
<i>Iva frutescens</i> , L.	<i>Aster tenuifolius</i> , L.
<i>Pluchea camphorata</i> , DC.	

11. BOGGY-WOODLAND FORMATION. *Helophytes*.

Habitat: low wet woodlands, swampy or boggy with a dense *Sphagnum* growth; much humus and substratum unimportant.

Contains many northern species, possible here only in cool, shady, humid situations.

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| * <i>Larix Americana</i> , Michx. | ° <i>Rhus venenata</i> , DC. |
| * <i>Pinus Strobus</i> , L. | <i>Symplocarpus foetidus</i> , Salisb. |
| * <i>Platanus occidentalis</i> , L. | <i>Veratrum viride</i> , Ait. |
| * <i>Betula populifolia</i> , Ait. | <i>Osmunda regalis</i> , L. |
| * <i>Chamaecyparis sphaeroidea</i> , Spach. | <i>Viola cucullata</i> , Ait. |
| * <i>Acer rubrum</i> , L. | <i>Equisetum sylvaticum</i> , L. |
| * <i>Carpinus Caroliniana</i> , Walt. | <i>Onoclea sensibilis</i> , L. |
| ° <i>Lindera Benzoin</i> , Blume. | <i>Osmunda cinnamomea</i> , L. |
| ° <i>Ilex verticillata</i> , Gray. | ° <i>Rhus Toxicodendron</i> , L. |
| ° <i>I. laevigata</i> , Gray. | <i>Sphagnum</i> spp. |
| ° <i>Nemopanthes fascicularis</i> , Raf. | |

12. SAND-POND FORMATION. *Hydrophytes.*

Habitat: ponds and slow-flowing streams throughout the sand-plain region with sandy bottom and little humus; plants rooted and usually submersed or upper leaves floating.

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| <i>Proserpinaca pectinacea</i> , Lam. | <i>Myriophyllum tenellum</i> , Bigel. |
| <i>Limnanthemum lacunosum</i> , Griseb. | <i>M. ambiguum</i> , Nutt. |
| <i>Hottonia inflata</i> , Ell. | <i>Nuphar Kalmianum</i> , Ait. |
| <i>Nymphaea odorata</i> , Ait. | <i>Lobelia Dortmanna</i> , L. |
| <i>Sagittaria teres</i> , Wats. | <i>Brasenia peltata</i> , Pursh. |
| <i>Naias Indica gracillima</i> , A. Br. | <i>Eriocaulon septangulare</i> , With. |
| <i>Orontium aquaticum</i> , L. | <i>Lycopodium inundatum Bigelovii</i> , |
| <i>Potamogeton Spirillus</i> , Tuckerm. | Tuck. |

13. MUD POND FORMATION. *Hydrophytes.*

Habitat: ponds and slow-flowing streams with bottom of clay or humus, often "mucky"; plants rooted and submersed or upper leaves floating, rarely emersed.

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| <i>Nuphar advena</i> , Ait. | <i>Ranunculus aquatilis trichophyllus</i> , |
| <i>Naias flexilis</i> , R. & S. | Gray. |
| <i>Myriophyllum spicatum</i> , L. | <i>Callitriche heterophylla</i> , Pursh. |
| <i>Nymphaea odorata</i> , Ait. | <i>Ranunculus multifidus</i> , Pursh. |
| <i>Marsilia quadrifolia</i> , L. | <i>Potamogeton crispus</i> , L. |
| <i>Chara fragilis</i> , Desv. | <i>P. natans</i> , L. and other species. |
| <i>Nitella flexilis</i> , Ag. | <i>Elodea Canadensis</i> , Michx. |
| <i>Podostemon ceratophyllus</i> , Michx. | <i>Vallisneria spiralis</i> , L. |